MASTER OF SCIENCE
COMPUTER SCIENCE

SYLLABUS

Choice Based Credit System (CBCS)
2022-2024

SFC PPP

FAKIR MOHAN AUTONOMOUS COLLEGE, BALASORE

PROGRAMME OUTCOMES

On successful completion of this programme the students will be able to:

- Develop core competence in various subjects of Computer Science.
- Apply Computer Science theory and software development concepts to construct computing-based solutions.
- Design and develop Computer programs/Computer-based systems in the areas related to Algorithms, Networking, Web Design, Cloud Computing, Artificial Intelligence, Mobile Applications etc.
- To identify, formulate, and develop solutions to computational challenges.
- To design, implement and evaluate a computational system to meet desired needs within realistic constraints.
- To analyse impacts of computing on individuals, organizations and society.
- To recognize the need of computation and ability to engage in continuing professional software system development.
- To use appropriate techniques, skills and tools necessary for computing practice.
- To apply design and development principles in the construction of software systems of varying complexity.
- Familiar with current research within various fields of Computer Science.

DISTRIBUTION OF MARK
Mid Semester Examination
Full Marks-20

1.	One Long Answer questions (LAQ) with One Alternative	12 marks
2.	Two Short Answer Question (SAQ) out of four options	2 x 4 =08 marks
		Total= 20 marks

Example

Q. No-1	LAQ Or LAQ	12 marks
Q. No-2	SAQ (Answer any two) a. b. c. d.	2 x 4= 08 marks
		Total = 20 marks

End Semester Examination
Full Marks-80

Section-A

10 Short Answer Questions (SAQ) — 20 marks
out of 12 Questions covering the entire Syllabus

Section-B

3 Long Answer Questions LAQ) each — 3 x 20= 60 marks
Question with one alternative set unit wise

Total= 80 marks

Example

Section-A

Q. No-1 SAQ (Answer any ten)

a.
b.
c.
d. — 2 x 10= 20 marks
e.
f.
g.
h.
i.
j.
k.
l.

Section-B

Q. No-2 Unit-I	LAQ Or LAQ	20 marks
Q. No-2 Unit-II	LAQ Or LAQ	20 marks
Q. No-2 Unit-III	LAQ Or LAQ	20 marks

Total= 80 marks

M. Sc COMPUTER SCIENCE SYLLABUS
CBCS Course Structure
Fakir Mohan Autonomous College, Balasore
2022-2024

Semester	Paper	Paper Name	Credit	Marks in Each Semester		Total
				Mid Sem	End Sem	
1ST SEMESTER	I	Discrete Mathematical Structures	04	20	80	100
	II	Computer System Architecture	04	20	80	100
	III	Data Structures and Algorithms	04	20	80	100
	IV	Database Systems	04	20	80	100
	V	Elective I [A. Object Oriented Programming using C++ **(Or)** B. Computer Graphics]	04	20	80	100
	VI(Pr)	Data Structures and Algorithms Lab	04	-	100	100
	VII(Pr)	Database Systems Lab	04	-	100	100
			28			700
2ND SEMESTER	VIII	Theory of Computation	04	20	80	100
	IX	Operating System Design	04	20	80	100
	X	Advanced JAVA	04	20	80	100
	XI	Computer Networks	04	20	80	100
	XII	Elective II [A. Mathematics for Data Science **(Or)** B. Cryptography and Network Security]	04	20	80	100
	XIII(Pr)	Operating System Lab	04	-	100	100
	XIV(Pr)	Advanced JAVA Lab	04	-	100	100
			28			700
3RD SEMESTER	XV	Software Engineering	04	20	80	100
	XVI	Compiler Design	04	20	80	100
	XVII	Artificial Intelligence	04	20	80	100
	XVIII	Elective III [A. Cloud Computing **(Or)** B. Soft Computing]	04	20	80	100
	XIX	Elective IV [A. Data Mining **(Or)** B. Mobile Computing]	04	20	80	100
	XX(Pr)	Artificial Intelligence Programming Lab	04	-	100	100
	XXI(Pr)	Python Programming Lab	04	-	100	100
			28			700
4TH SEMESTER	XXII	Comprehensive Viva	04	-	100	100
	XXIII	Project Work and Viva Voce	12	-	300	300
			16			400
		Total	**100**			**2500**

CONTENTS

FIRST YEAR
Semester- I

Credit-4 **F.M: 20+80=100**

PAPER-I

DISCRETE MATHEMATICAL STRUCTURES

Prerequisites:

- Elementary Algebra
- Elementary Calculus

Course Outcomes:

- Learning the mathematical foundations for computer science
- Development of an essential understanding of mathematical concepts for other courses in computer science

UNIT-I

Logic and Proofs: Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifies, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy. Basic Structures: Sets, Set Operations, Functions, Sequences and Summations.

UNIT-II

Counting: The basics of counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Recurrence relations, Solving Linear Recurrence Relations, Generating functions, inclusion – exclusion, Relations: Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Ordering.

UNIT-III

Graphs and Trees: Introduction to graphs, graph terminology, Representing graphs and graph isomorphism, Euler and Hamilton paths, introduction to trees, applications of trees, tree traversals. Boolean Algebra: Boolean functions, Representing Boolean functions, Logic gates, Minimization of circuits.

Text Books:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", **Sixth Edition**, Mc Graw Hill.

Reference Books:

1. J. L. Mott, A. Kandel, T . P . Baker: " Discrete Mathematics for Computer Science and Mathematics", **Second Edition**, Pearson.
2. C.L. Liu, "Elements of Discrete Mathematics", **Third Edition**, Mc Graw Hill.

FIRST YEAR
Semester- I

Credit-4 **F.M: 20+80=100**

PAPER-II

COMPUTER SYSTEM ARCHITECTURE

Prerequisites:

- Digital Logic
- Data Structures

Course Outcomes:

- Knowledge of the principles and basic architectural concepts of computer organization
- Understanding the background of internal communication in computers

UNIT-I

The Computer System: Computer Components, Computer Function, Interconnection Structures, Bus Interconnection, PCI. Cache Memory: Computer Memory System, Cache Memory Principles, Elements of Cache Design, Input/Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels and Processors.

UNIT-II

Instruction Sets: Machine Instruction Characteristics, Types of Operands, Types of Operations, Addressing, Instruction Formats, Processor Structure and Function: Processor Organization, Register Organization, Instruction Cycle, Instruction Pipelining, Reduced Instruction Set Computer (RISC): Instruction Execution Characteristics, The Use of a Large Register File, Compiler- Based Register Optimization, Reduced Instruction Set Architecture, RISC Pipelining.

UNIT-III

Control Unit Operation: Micro-operations, Control of the Processor, Hardwired Implementation, Microprogrammed Control: Basic Concepts, Microinstruction Sequencing, Microinstruction Execution.

Text Book:

1. W. Stallings: “Computer Organization and Architecture”, **Eighth Edition**, Pearson.

Reference Books:

1. Mano. M. M.: “Computer System Architecture”, **Third Edition**, Prentice Hall India.
2. C. Hamacher, Z Vranesic, S. Zaky, “Computer Organization”, **Fifth Edition**, Tata Mc. Graw-Hill.

FIRST YEAR
Semester- I

Credit-4 **F.M: 20+80=100**

PAPER-III

DATA STRUCTURES AND ALGORITHMS

Prerequisites:

- Discrete Mathematics
- Elementary Algebra

Course Outcomes:

- Ability to learn design principles and concepts of algorithms
- The creation of a mathematical foundation for algorithm analysis

UNIT-I

Introduction: The Role of algorithms in computing, Growth of functions, Recurrences, Heapsort, Quicksort, Sorting in linear time, Data Structures: Elementary Data structures, Hash Tables, Binary Search Trees, Red-Black trees, B-Trees.

UNIT-II

Graph algorithms: Elementary Graph algorithms, Representation of Graphs, BFS, DFS and Topological Sort, Minimum Spanning Trees, The algorithms of Kruskal and Prim, Single-Source Shortest Path Algorithms, All-Pairs Shortest Path Algorithms, Maximum Flow.

UNIT- III

Dynamic programming: Rod cutting, Matrix Chain multiplication, Longest common subsequence, Optimal binary Search trees, Greedy algorithms: An activity-selection problem, Elements of the greedy strategy, Huffman codes, P, NP and NP-Completeness.

Text Books:

1. T.H.Corman, C.E.Leiserson, R.L.Rivest and C. Stein : “Introduction to Algorithms”, **Third Edition**, Prentice Hall India.

Reference Books:

1. J Kleinberg, Eva Tardos: “Algorithm Design”, **First Edition**, Pearson.
2. A.V. Aho, J.E.Hopcroft and J.D.Ullman: “The Design and Analysis of Computer Algorithms”, **First Edition**, Pearson.

FIRST YEAR
Semester- I

Credit-4 **F.M: 20+80=100**

PAPER-IV
DATABASE SYSTEMS

Prerequisites:

- Discrete Mathematics
- Data Structures Algorithms

Course Outcomes:

- Ability to understand the relational database concepts and design principles
- Understanding the SQL basics and ability to construct queries using SQL**.**

UNIT I

Database Concepts and Architecture: Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence. Relational Data Model: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas. Conceptual Modeling: Entity Types, Entity Sets, Attributes, Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions. Enhanced Entity-Relationship (EER) Model.

UNIT II

Basic SQL: Data Definition and Data Types, Constraints, INSERT, DELETE, UPDATE Statements, Relational Algebra and Relational Calculus: SELECT and PROJECT operations, Binary Relation: JOIN and DIVISION. The Tuple Relational Calculus, The Domain Relational Calculus. Query Processing and Optimization: Translating SQL Queries into Relational Algebra, External Sorting algorithm, Algorithms for SELECT, JOIN, PROJECT and Set Operations, Aggregate Operations and OUTER JOINs.

UNIT III

Database Design: Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Transaction Management: Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability and Serializability. Concurrency Control Techniques: Two-Phase Locking Techniques, Concurrency Control Based on Timestamp Ordering.

Text Book:

1. Ramez Elmasri, Shamkant B. Navathe: “Fundamentals of Database Systems”, **Sixth Edition**, Pearson.

Reference Books:

1. Silbcrschatz. A, Korth, H.F., Sudarshan.S.: “Database System Concepts”, **Sixth Edition**, Tata Mc. Graw-Hill.

FIRST YEAR
Semester- I

Credit-4 **F.M: 20+80=100**

PAPER-V: ELECTIVE I

A. OBJECT ORIENTED PROGRAMMING USING C++

Prerequisites:

- C Programming Language
- Data Structures

Course Outcomes:

- Development of understanding on the object-oriented programming concepts
- Ability to develop logic to create programmers and applications in C++

UNIT-I

Principles of Object-Oriented Programming: Basic Concepts of OOP, Structure of C++ Program, Tokens, Keywords, Data Types, Operators, Expressions, Control Structures. Functions in C++: The main function, call by reference, Argument passing, Inline Functions, Function overloading. Classes and Objects: Member Functions, Making an outside Function Inline, Private Member Functions, Memory Allocation for Objects, Static Data Members, Static Member Functions, Friend Functions.

UNIT-II

Constructors & Destructors: Constructors, Parameterized Constructors, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Dynamic Constructors, Destructors, Operator overloading and type conversions. Inheritance: Basics of Inheritance, Type of Inheritance, Virtual Base Classes, Abstract Classes, Member Classes, Nesting of Classes. Polymorphism: Pointers, Pointers to Objects, this Pointer, Pointers to Derived Classes, Virtual Functions, Pure Virtual Functions.

UNIT-III

Files: Classes for File Stream Operations, File Modes, File Pointers and their Manipulations, Sequential Input and Output Operations, Random Access, Error Handling during File Operations, Command-line Arguments. Templates: Class Templets, Function Templets, Overloading of Templet functions, Member Function Templets, Non-type Templet Arguments, Standard Templet Library (STL): Components of STL, Containers, Algorithms, Iterators, Application of Container Classes, Function Objects.

Text Book:

1. E. Balgurusawmy: “Object Oriented Programming with C++”, **Seventh Edition**, Mc. Graw-Hill.

Reference Books:

1. Herbtz Schildt: “C++: The Complete reference”, **Fourth Edition**, Mc. Graw-Hill.

FIRST YEAR
Semester- I

Credit-4 **F.M: 20+80=100**

PAPER-V: ELECTIVE I

B. COMPUTER GRAPHICS

Prerequisites:

- Linear Algebra
- Data Structure and Algorithms

Course Outcomes:

- Learning the core concepts of Computer Graphics
- Ability to create effective programs for solving graphics problems

UNIT I

Overview of graphics Systems: Raster Scan Systems, Random Scan Systems, Graphics software. Output Primitives: Line drawing Algorithms, Circle generating Algorithms, Ellipse generating algorithms, Filled-Area Primitives. Attributes of Output Primitives: Line Attributes, Curve Attributes, Area-Fill Attributes, Character Attributes, Bundled attributes, Antialiasing.

UNIT II

Basic Transformations, Matrix representation and Homogenous Coordinates, Composite Transformations, Reflection and Shear, Transformation between coordinate systems. Two-dimensional viewing: The Viewing Pipeline, Viewing coordinate reference frame, Window to viewport coordinate transformation, Line Clipping (Cohen-Sutherland & Liang-Barsky algorithm), Polygon Clipping (Sutherland-Hodgeman Algorithm).

Unit III

Three-dimensional object Representations: Polygon Surfaces, Quadratic Surfaces, Spline Representation, Bezier Curves and Surfaces, B-Spline Curves and Surfaces, Fractal Geometry Methods: Fractal Generation Procedures, Classification of Fractals, Fractal Dimension, Geometric Construction of Deterministic Self Similar Fractals, Self-Squaring fractals.

Text Books:

1. Donald Hearn & M. Pauline Baker, “Computer Graphics”, **Second Edition**, Pearson.

Reference Books:

1. J.D. Foley, A. Dam, S.K. Feiner, J.F. Hughes: “Computer Graphics Principle and Practice”, **Second Edition**, Pearson.

FIRST YEAR
Semester- I

Credit-4 **F.M: 100**

PAPER-VI: PRACTICAL

DATA STRUCTURES AND ALGORITHMS LAB

Write C/C++ program for the implementation of the followings:

1. Stack & Queue operations using Linked List.
2. To Implement Binary Search Tree.
3. To find the largest item in a Binary Search Tree.
4. Graph representation of adjacency matrix & adjacency lists.
5. To implement BFS.
6. To implement DFS.
7. Evaluating polynomial operations using Linked lists.
8. Implementing operations related to Hashing.
9. To implement Topological Sort.
10. To implement Red-Black Trees.
11. To perform B-Tree operations.
12. To compute LCS between two strings.
13. To perform Heap Sort.
14. To perform Quick sort.
15. To implement Huffman code.
16. To implement Prims algorithm.
17. To implement Kruskal's algorithm.
18. To implement Bellman-Ford algorithm.
19. To implement Dijkstra's algorithm.
20. To implement Floyd-Warshall's algorithm.

FIRST YEAR
Semester- I

Credit-4 **F.M: 100**

PAPER-VII: PRACTICAL

DATABASE SYSTEMS LAB

Create and use the following database schema to answer the given queries.

EMPLOYEE Schema:

Field	Type	NULL	KEY	DEFAULT
Eno	Char(3)	NO	PRI	NIL
Ename	Varchar(50)	NO		NIL
Job_type	Varchar(50)	NO		NIL
Manager	Char(3)	Yes	FK	NIL
Hire_date	Date	NO		NIL
Dno	Integer	YES	FK	NIL
Commission	Decimal(10,2)	YES		NIL
Salary	Decimal(7,2)	NO		NIL

DEPARTMENT Schema:

Field	Type	NULL	KEY	DEFAULT
Dno	Integer	No	PRI	NULL
Dname	Varchar(50)	Yes		NULL
Location	Varchar(50)	Yes		New Delhi

SQL Statements:

1. Insert at least 10 entries in to the above two tables.
2. Perform update operation on both the tables.
3. Delete at least one entry from both the tables.
4. Perform rollback operation on database.
5. Perform commit operation on database.

SQL Query List:

1. Query to display Employee Name, Job, Hire Date, Employee Number; for each employee with the Employee Number appearing first.
2. Query to display unique Jobs from the Employee Table.
3. Query to display the Employee Name concatenated by a Job separated by a comma.
4. Query to display all the data from the Employee Table. Separate each Column by a comma and name the said column as THE_OUTPUT.
5. Query to display the Employee Name and Salary of all the employees earning more than ₹28500.
6. Query to display Employee Name and Department Number for the Employee No= 7900.
7. Query to display Employee Name and Salary for all employees whose salary is not in the
   range of ₹15000 and ₹28500.
8. Query to display Employee Name and Department No. of all the employees in Dept 10 and Dept 30 in the alphabetical order by name.
9. Query to display Name and Hire Date of every Employee who was hired in 2001.
10. Query to display Name and Job of all employees who don't have a current Manager.
11. Query to display the Name, Salary and Commission for all the employees who earn commission.
12. Sort the data in descending order of Salary and Commission.
13. Query to display Name of all the employees where the third letter of their name is 'A'.
14. Query to display Name of all employees either have two 'R's or have two 'A's in their name and are either in Dept No = 30 or their Mangers Employee No = 7788.
15. Query to display Name, Hire Date and Salary Review Date which is the 1st Monday after six months of employment.
16. Query to display Name and calculate the number of months between today and the date each employee was hired.
17. Query to display the following for each employee <E-Name> earns < Salary> monthly but wants <3*Current Salary>. Label the Column as Dream Salary.

18. Query to display Name with the 1st letter capitalized and all other letter lower case and length of their name of all the employees whose name starts with ‘J’, ‘A’ and ‘M’.
19. Query to display Name, Hire Date and Day of the week on which the employee started.
20. Query to display Name, Department Name and Department No for all the employees.
21. Query to display Unique Listing of all Jobs that are in Department # 30.
22. Query to display Name, Department Name of all employees who have an ‘A’ in their name.
23. Query to display Name, Job, Department No. and Department Name for all the employees working at the Bhubaneswar location.
24. Query to display Name and Employee no. Along with their Manger’s Name and the Manager’s employee no; along with the Employees Name who do not have a Manager.
25. Query to display Name, Department No. and Salary of any employee whose department No. and salary matches both the department no. and the salary of any employee who earns a commission.
26. Query to display Name and Salaries represented by asterisks, where each asterisk (*) signifies ₹1000.
27. Query to display the Highest, Lowest, Sum and Average Salaries of all the employees.
28. Query to display the number of employees performing the same Job type functions.
29. Query to display the no. of managers without listing their names.
30. Query to display the Department Name, Location Name, No. of Employees and the average salary for all employees in that department.
31. Query to display Name and Hire Date for all employees in the same dept. as Satya.
32. Query to display the Employee No. And Name for all employees who earn more than the average salary.
33. Query to display Employee Number and Name for all employees who work in a department with any employee whose name contains a ‘T’.
34. Query to display the names and salaries of all employees who report to Mohan.
35. Query to display the department no, name and job for all employees in the Sales department.

FIRST YEAR
Semester- II

Credit-4 **F.M: 20+80=100**

PAPER-VIII

THEORY OF COMPUTATION

Prerequisites:

- Discrete Mathematics
- Data Structures and Algorithms

Course Outcomes:

- Acquire knowledge on formal computation and its relationship to languages
- Ability to recognize and comprehend formal reasoning about languages

UNIT I

Deterministic Finite Automata, Non-deterministic Finite Automata, Equivalence of NFA and DFA, Conversion of DFAs to Regular Expressions and vice versa, Regular Languages: Pumping Lemma, Closure properties: Union,Intersection, Complement, Difference, Reversal, Homomorphism, and Inverse Homomorphism, Decision Properties of Regular Languages, DFA Minimization.

UNIT II

Context Free Languages: Context Free Grammars, Derivation, Ambiguity, Parsing. Pushdown Automata: Acceptance of PDAs by final state and by empty stack. Conversion of CFG to PDA and vice versa. DPDAs & DCFLs, Properties of Context Free Languages: Normal Forms for Context Free Languages, Chomsky Normal Form. The Pumping Lemma for CFL's. Closure Properties of Context Free Languages,

UNIT III

Turing Machines: Notations, Transition Diagram, Language of a Turing Machine, Halting, Programming Techniques for Turing Machines. Extension to the basic Turing machine, Restricted Turing machine, Turing machines and computers. Undecidability: A language that is not recursively enumerable, an undecidable problem that is RE, Undecidable problem about Turing machine.

Text Book:

1. J. E. Hopecroft, R. Motwani, J. D. Ullman: "Introduction to Automata Theory, Languages and Computation", **Third Edition**, Pearson.

Reference Books:

1. M. Sipser: "Introduction to Theory of Computation", Thomson Learning.

FIRST YEAR
Semester- II

Credit-4 **F.M: 20+80=100**

PAPER-IX

OPERATING SYSTEM DESIGN

Prerequisites:

- Computer System Architecture
- Data Structures and Algorithms

Course Outcomes:

- Develop understanding on operating system structure and services
- Comprehend the concept of Process, Memory, Storage and I/O management

UNIT- I

Operating-System Structures: System Calls, System Programs, OS Design and Implementation, Operating System Structure. Processes: Process Concept, Process Scheduling, Operations on Processes, Inter-Process Communication, Threads: Multithreading Models, Thread Libraries, Threading Issues. Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors.

UNIT- II

Process Scheduling: Basic Concepts, Scheduling Algorithms, Deadlocks: System Model, Methods of Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, Recovery from Deadlock. Memory Management Strategies: Swapping, Contiguous Memory Allocation, Paging, Segmentation. Virtual-Memory: Demand Paging, Page Replacement, Allocation of Frames, Thrashing.

UNIT- III

File System: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection: Goals and Principles of Protection, Domain of Protection, Access Matrix and its Implementation, Access Control, Revocation of Access Rights, Security: The Security Problem, Program Threats, System and Network Threats, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks.

Text Book:

1. Silberschatz, Galvin, Gagne.: "Operating System Concepts**"**, **Ninth Edition**, Wiley-India.

Reference Books:

1. William Stallings, "Operating Systems", **Fifth Edition**, Pearson.

FIRST YEAR
Semester- II

Credit-4 **F.M: 20+80=100**

PAPER-X
ADVANCED JAVA

Prerequisites:

- C or C++ programming Language
- Database Systems

Course Outcomes:

- Ability to develop error-free, well-documented advance Java programs
- Ability to develop web application using JDBC, Servlet and JSP

UNIT-I

Introduction to JAVA & its various features, JAVA Virtual Machine and its architecture. Installation of JDK and 'CLASSPATH' setting, A First Java Program, Class, Object, Instance Data and Class Data, Methods, Constructors, Access Modifiers, Inheritance, Method overriding, Dynamic method dispatch, abstract class, interface, Wrapper class, boxing unboxing, autoboxing and auto-unboxing, Package, multithreading, exception handling, console and File I/O.

UNIT-II

JDBC Programming: Introduction to JDBC, JDBC Drivers, Features of JDBC, JDBC APIs, The DriverManager Class, The Driver Interface, The Connection Interface, The Statement Interface, Understanding Basic JDBC Steps, creating a Simple JDBC Application, working with the PreparedStatement Interface, working with the CallableStatement Interface, Working with ResultSets.

UNIT-III

Servlets: Exploring the Features of Java Servlet, The javax.servlet and javax.servlet.http Package, Explaining the Servlet Life Cycle, Creating a Sample Servlet, Working with ServletConfig and ServletContext Objects, Working with the HttpServletRequest and HttpServletResponse Interfaces, Describing a Session, Session Tracking. Java Server Pages (JSP): Architecture of a JSP Page, The Life Cycle of a JSP Page, JSP Basic Tags and Implicit Objects, Action Tags in JSP.

Text Book:

1. Herbert Schildt: "Java - The Complete Reference", **Ninth Edition**, Mc. Graw-Hill.
2. M.T. Savaliya: "Advanced Java", **Revised Edition 2016**, Dreamtech Press.

Reference Books:

1. R. Nageswara: "Core Java: An Integrated Approach", **2016**, Dreamtech Press.
2. Mahesh P. Matha: "JSP and Servlets", **2013**, Prentice Hall India.

FIRST YEAR
Semester- II

Credit-4 **F.M: 20+80=100**

PAPER-XI
COMPUTER NETWORKS

Prerequisites:

- Operating Systems
- Data Structures and Algorithms

Course Outcomes:

- Understanding on the fundamental concepts of computer networking
- Exposure to the components of computer networks and their working principles

UNIT-I

Computer Networks and the Internet: What Is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and Their Service Models, Application Layer: Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS-The Internet's Directory Service.

UNIT-II

Transport Layer: Introduction and Transport-Layer Services, Multiplexing and Demultiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control.

UNIT-III

The Network Layer: Introduction, What's Inside a Router? The Internet Protocol (IP): IPv4 Addressing, IPv6, Forwarding and SDN, Routing Algorithms: Link State and Distance Vector. The Link Layer: Services of Link Layer, Error-Detection and -Correction Techniques, Multiple Access Protocols, Switched Local Area Networks, Link Virtualization.

Text Book:

1. James F. Kurose, Keith W. Ross: "Computer Networking A Top Down Approach", **Eighth Edition**, Pearson.

Reference Books:

1. Larry L. Peterson, Bruce S. Davie: "Computer Networks A System Approach", **Fifth Edition**, Morgan Kaufmann.
2. A.S. Tanenbaum.: "Computer Networks", **Sixth Edition**, Pearson.

FIRST YEAR
Semester- II

Credit-4 **F.M: 20+80=100**

PAPER-XII: ELECTIVE II
A. MATHEMATICS FOR DATA SCIENCE

Prerequisites:

- Elementary Algebra
- Elementary Calculus

Course Outcomes:

- Learning the mathematical foundations for Data Science
- Understanding the fundamental concepts of probability, statistics and algebra

UNIT I

Probability: Joint Probabilities, Union Probabilities, Conditional Probability and Bayes Theorem, Joint and Union Conditional Probabilities, Binomial Distribution, Beta Distribution. Descriptive Statistics: Populations, Samples, and Bias, Mean and Weighted Mean, Median, Mode, Variance and Standard Deviation.

UNIT II

Inferential Statistics: The Normal Distribution, The Inverse CDF, Z-Scores, The Central Limit Theorem, Confidence Intervals, Understanding P-Values, Hypothesis Testing, The T-Distribution: Dealing with Small Samples. Linear Algebra: Vector, Linear Transformations, Determinants, Matrix, Systems of Equations and Inverse Matrices, Eigenvectors and Eigenvalues.

UNIT III

Linear Regression: A Basic Linear Regression, Residuals and Squared Errors, Finding the Best Fit Line, Overfitting and Variance, Stochastic Gradient Descent, The Correlation Coefficient Statistical Significance, Coefficient of Determination, Standard Error of the Estimate, Prediction Intervals, Train/Test Splits, Multiple Linear Regression.

Text Book:

1. Thomas Nield: “Essential Math for Data Science”, **2022**, O'Reilly Media.

Reference Books:

1. Gilbert Strang: “Linear Algebra and its Applications”, **Fourth Edition**, Cengage.
2. Howard Anton, Chris Rorres: “Elementary Linear Algebra with Supplemental Applications”, **Eleventh Edition**, Wiley.
3. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye: “Probability & Statistics for Engineers & Scientists”, **Ninth Edition**, Pearson.

FIRST YEAR
Semester- II

Credit-4 **F.M: 20+80=100**

PAPER-XII: ELECTIVE II
B. CRYPTOGRAPHY AND NETWORK SECURITY

Prerequisites:

- Computer Networks
- Discrete Mathematics and Algebra

Course Outcomes:

- Understand the basics of Cryptography and Network Security.
- Acquire knowledge on protocols for security to protect against threats in the networks

UNIT I

Security Concepts: Security Attacks, Services and Mechanisms, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography. Block Ciphers and the Data Encryption Standard, Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example.

UNIT II

Public-Key Cryptosystems, The RSA Algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic System, Elliptic Curve Cryptography, Pseudorandom Number Generation Based on an Asymmetric Cipher, Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys.

UNIT III

Transport-Level Security: Web Security Considerations, Transport Layer Security, HTTPS, Secure Shell (SSH), Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11, IEEE 802.11i Wireless LAN Security, IP Security: IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

Text Books:

1. W. Stallings.: “Cryptography and Network Security Principles and Practice”, **Seventh Edition**, Pearson.

Reference Books:

1. D. R. Stinson, Maura B. Paterson.: “Cryptography: Theory and Practice”, **Fourth Edition**, CRC Press.

FIRST YEAR
Semester- II

Credit-4 **F.M: 20+80=100**

PAPER-XIII

OPERATING SYSTEM LAB

1. Basics of Unix Commands.
2. Program for system calls of Unix operating systems (opendir, readdir, closedir).
3. Program for system calls of Unix operating system (fork, getpid, exit).
4. Write a Shell program to check the given number is even or odd.
5. Write a Shell program to check the given year is leap year or not.
6. Write a Shell program to find the factorial of a number.
7. Write a Shell program to swap the two integers.
8. Write a C program for implementation of Priority scheduling algorithms.
9. Write a C program for implementation of Round Robin scheduling algorithms.
10. Write a C program for implementation of FCFS and SJF scheduling algorithms.
11. Write a C program for implementation of SJF scheduling algorithms.
12. Write a C-program to implement the producer - consumer problem using semaphores.
13. Write a c program to implement IPC using shared memory.
14. Write a C program to implement banker's algorithm for deadlock avoidance.
15. Write a C program to implement algorithm for deadlock detection.
16. Write a c program to implement Threading and Synchronization Applications.
17. Write a C program for implementation memory allocation methods for fixed partition using first fit.
18. Write a c program to implement Paging technique for memory management.
19. Write a C program for implementation of FIFO page replacement algorithm.
20. Write a c program to implement LRU page replacement algorithm.

FIRST YEAR
Semester- II

Credit-4 **F.M: 20+80=100**

PAPER-XIV

ADVANCED JAVA LAB

1. Write a Program to print the text “Welcome to World of Java”. Save it with name Welcome.java in your folder.
2. Write a program to create a class Student with data ‘name, city and age’ along with method printData to display the data. Create the two objects s1, s2 to declare and access the values.
3. Write a program in JAVA to demonstrate the method and constructor overloading.
4. Write a Java program to illustrate the concept of Multilevel inheritance.
5. Write a java program in which you will declare an abstract class Vehicle inherits this class from two classes car and truck using the method engine in both display “car has good engine” and “truck has bad engine”.
6. Write a JDBC program to create a table in the database.
7. Write a JDBC program to insert values in to the table.
8. Write a JDBC program to selecting data from the table.
9. Write a JDBC program to update values in the table.
10. Write a JDBC program to insert values using PreparedStatement.
11. Write a Servlet program to print welcome message in the browser.
12. Write a Servlet program to accept username and password as parameters and return login success or failure as response.
13. Write a Servlet program to accept input as a sql command and execute it in the database.
14. Write a Servlet program to perform Html & Servlet Communication.
15. Write a Servlet program to Count the visits on web page.
16. Write a JSP program Print current date & time.
17. Write a JSP Program to upload file into server.
18. Write a JSP program for performing error handling.
19. Write a JSP program to Demonstrate expression tags.
20. Write a JSP Program to select a record from database.

SECOND YEAR
Semester- III

Credit-4 **F.M: 20+80=100**

PAPER-XV
SOFTWARE ENGINNERING

Prerequisites:

- C/C++/Java Programming Language
- Elementary Algebra

Course Outcomes:

- Ability to develop software with high quality and correctness
- Familiarize with software engineering principles for industry standard

UNIT I

Introduction to software Engineering, Software Life Cycle Models: Waterfall Model and its extensions, RAD, Agile, Spiral, Software Project Management, Requirements Analysis and Specification: Requirement gathering and Analysis, The Software Requirements Specification, Software design: Methods and strategies, Characteristics of a good design, Cohesion and coupling.

UNIT II

Function-Oriented Software Design: Structured analysis, DFD Model, Structured design, Detailed design, Object Modelling using UML: UML diagrams, Use case models, Class diagram, Interaction diagrams, Activity diagrams, State chart diagram, Coding and Testing: Coding, Code Review, Software documentation, Testing, Unit, Integration, System Testing, Black box and White box testing, General issues associated with testing.

UNIT III

Software Reliability, Statistical Testing, Software quality, Software quality management system, ISO 9000, SEI Capability Maturity Model, Six Sigma, Computer Aided Software Engineering (CASE): Scope, Environment, CASE support in Software life cycle, Architecture of a CASE Environment, Software Maintenance: Characteristics of Software Maintenance, Reverse Engineering, Maintenance process models, Estimation of Maintenance Cost.

Text Book:

1. Rajib Mall, "Fundamentals of Software Engineering", **Fifth Edition**, Prentice Hall India.

Reference Books:

1. R.S. Pressman, "Software Engineering, A practitioner's approach", **Seventh Edition**, McGraw Hill.
2. I. Sommerville: “Software Engineering”, **Ninth Edition**, Pearson.

SECOND YEAR
Semester- III

Credit-4 **F.M: 20+80=100**

PAPER-XVI
COMPILER DESIGN

Prerequisites:

- Theory of Computation
- Data Structures and Algorithms

Course Outcomes:

- Understand basic principles of compiler design and its various constituents
- Learning the process of translating a high-level language in to executable code

UNIT-I

The Structure of a Compiler: Lexical Analysis, Syntax Analysis, Semantic Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Symbol Table, Lexical Analysis: The Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens. Design of a Lexical Analyzer Generator, Syntax Analysis: Context free grammars, Writing a grammar, Top down parsing, Bottom Up Parsing, Introduction to LR Parsing: Simple LR, Parser Generators.

UNIT-II

Syntax-Directed Translation: Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's, Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Backpatching, Switch-Statements.

UNIT-III

Code Generation: Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Code Optimizations: The Principal Sources of Optimization, Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs, Region-Based Analysis, Symbolic Analysis.

Text Book:

1. A.V.Aho, M.S.Lam, Ravi Esthi and J.D.Ullman.: "Compilers Principles Techniques and Tools", **Second Edition**, Pearson.

Reference Books:

1. S. Chattopadhyay.: "Compiler Design", **2005**, Prentice Hall India.
2. Allen I Holub: "Compiler Design in C", **2015**, Pearson.

SECOND YEAR
Semester- III

Credit-4 **F.M: 20+80=100**

PAPER-XVII
ARTIFICIAL INTELLIGENCE

Prerequisites:

- Data Structures and Algorithms
- Discrete Mathematics

Course Outcomes:

- Understanding the basic concepts, principles and approaches of AI
- Development of basic understanding on the building blocks of AI

UNIT-I

Introduction: What is AI, History of AI, Intelligent Agents: Agents and Environments, Problem Solving by Searching: BFS, Uniform Cost Search, DFS, Iterative deepening search, Bi-directional Search, Informed Search: Best First Search, Heuristic Function, Memory bounded search, A* and IDA*, Game Playing: Min-Max search and Alpha-Beta pruning.

UNIT-II

Knowledge & Reasoning: Logical Agents, First Order Logic, Syntax and Semantics. Inference in First Order Logic: Inference Rules, Modus Ponens, Unification, Forward and Backward Chaining, Resolution, Automated Planning: Classical Planning, Algorithms for Classical Planning, Heuristics for Planning, Hierarchical Planning.

UNIT-III

Learning: Learning from Examples, Forms of Learning, Supervised Learning, The Theory of Learning, Linear regression and Classification, Ensemble Learnings, Knowledge in Learning: Explanation Based Learning, Learning using Relevance information, Natural Language Processing: Language Models, Grammar, Parsing, Augmented Grammars, Robotics.

Text Book:

1. Stuart Russel & Peter Norvig: “Artificial Intelligence A Modern Approach”, **Fourth Edition**, Pearson.

Reference Books:

1. Rich & Knight: “Artificial Intelligence”, **Third Edition**, Tata McGraw Hill.

SECOND YEAR
Semester- III

Credit-4 **F.M: 20+80=100**

PAPER-XVIII: ELECTIVE-III
A. CLOUD COMPUTING

Prerequisites:

- Computer Networks
- Operating Systems

Course Outcomes:

- Learning of concepts, characteristics, models and benefits of cloud computing
- Understanding the different characteristics of public, private and hybrid cloud

UNIT I

Defining Cloud Computing: Defining Cloud Computing, Cloud Types, Examining the Characteristics of Cloud Computing, Understanding Cloud Architecture: Exploring the Cloud Computing Stack, Understanding Services and Applications by Type: Infrastructure as a Service, Platform as a Service, Software as a Service, Identity as a Service, Compliance as a Service.

UNIT II

Understanding Abstraction and Virtualization: Using Virtualization Technologies Load Balancing and Virtualization, Understanding Hypervisors, Understanding Machine Imaging, Porting Applications, Capacity Planning: Defining Baseline and Metrics, Network Capacity, Scaling, Google Web Services, Amazon Web Services, Microsoft Cloud Services.

UNIT III

Managing the Cloud: Administrating the Clouds, Cloud Management Products, Cloud Management Standards, Understanding Cloud Security: Securing the Cloud, Securing Data, Establishing Identity and Presence, Service Oriented Architecture: Introduction, Defining SOA Communications, Managing and Monitoring SOA, Relating SOA and Cloud Computing, Moving Applications to the Cloud: Applications in the Clouds.

Text Book:

1. Barrie Sosinsky, “Cloud Computing Bible”, Wiley India.

Reference Books:

1. R. Buyya, J. Broberg, A. Goscinski.:" Cloud Computing Principles and Paradigms", **First Edition**, Wiley India.
2. T. Erl, R. Puttini, Z. Mahmood: “Cloud Computing: Concepts, Technology & Architecture”, **First Edition**, Pearson.

SECOND YEAR
Semester- III

Credit-4 **F.M: 20+80=100**

PAPER-XVIII: ELECTIVE-III
B. SOFT COMPUTING

Prerequisites:

- Mathematics for Data Science
- Data Structures and Algorithms

Course Outcomes:

- Acquire knowledge on soft computing techniques and their applications
- Understand neural networks, fuzzy systems and genetic algorithms

UNIT I

Introduction to Soft Computing, Artificial Neural Network: Fundamental Concept, Evolution of Neural Networks, Basic Models, Important Technologies of ANN, McCulloch Pits Neuron, Linear Separability, Hebb Network, Supervised Learning Network: Perceptron Network, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Backpropagation Network, Radial Basis Function Network.

UNIT II

Introduction to Fuzzy Logic, Classical Sets, Fuzzy Sets, Classical Relations and Fuzzy Relations, Tolerance and Equivalence Relations, Noniterative Fuzzy Sets, Membership function: Introduction, Features of Membership function, Fuzzification, Methods of Membership value assignments, Defuzzification, Fuzzy arithmetic and measures, Fuzzy Rule base and Approximate Reasoning, Fuzzy decision Making.

UNIT III

Genetic Algorithm (GA): Introduction, Biological Background, Traditional Optimization and Search Techniques, Genetic Algorithm and Search Space, Basic Terminology In GA: Encoding, Selection, Crossover, Mutation, Stopping Condition for GA Flow, Constraints in GA, Problem solving using GA, The Schema Theorem, Classification of GA, Holland Classifier System.

Text Book:

1. S. N. Sivanandam, S. N. Deepa.: “Principles of Soft Computing”, **Third Edition**, Wiley India.

Reference Books:

1. S Roy, U Chakraborty.: “Introduction to Soft Computing”, **First Edition**, Pearson.
2. S. Rajasekaran, Dr G. A. Vijayalakshmi Pai.: “Neural networks, fuzzy logic, and genetic algorithms: synthesis and application”, **First Edition**, Prentice Hall India.

SECOND YEAR
Semester- III

Credit-4 **F.M: 20+80=100**

PAPER-XIV: ELECTIVE-IV
A. DATA MINING

Prerequisites:

- Mathematics for Data Science
- Data Structures and Algorithms

Course Outcomes:

- Learning concepts of data warehousing, data mining issues and implications
- Exposure to the applications and trends in the Data Mining field

UNIT-I

Introduction, Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity, Data Pre-Processing: Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization, Data Warehouse, Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.

UNIT-II

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Frequent Itemset Mining Methods, Pattern Evaluation Methods, Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Advanced Classification Methods: Bayesian Belief Networks, Classification by Backpropagation.

UNIT-III

Cluster Analysis: Basic Concepts and Methods: Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering, Advanced Cluster Analysis: Probabilistic Model-Based Clustering, Clustering High-Dimensional Data, Clustering Graph and Network Data, Clustering with Constraints.

Text Books:

1. Jiawei Han, Micheline Kamber.: "Data Mining: Concepts and Techniques", **Third Edition**, Morgan Kaufman.

Reference Books:

1. Arun K Pujari: "Data Mining Techniques", **Second Edition**, Universities Press.
2. Pang-Ning Tan, M. Steinbach, A. Karpatne, Vipin Kumar.: "Introduction to Data Mining", **Second Edition**, Pearson.

SECOND YEAR
Semester- III

Credit-4 **F.M: 20+80=100**

PAPER-XIV: ELECTIVE-IV
B. MOBILE COMPUTING

Prerequisites:

- Computer Networks
- Data Structures and Algorithms

Course Outcomes:

- Understanding the mobile computing concept in the existing mobile computing frameworks and architectures
- Exposure to the mobile computing paradigm in terms of hardware, software, and communications

UNIT I

Introduction, Wireless transmission: Signals, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems, Medium access control: SDMA, FDMA, TDMA, CDMA, Telecommunications systems: GSM, DECT, TETRA, UMTS and IMT 2000.

UNIT II

Satellite systems: Basics, Routing, Localization, Handover, Wireless LAN: IEEE 802.11, HIPERLAN, Bluetooth, Radio Layer, Baseband Layer, L2CAP, Mobile network layer: Mobile IP, DHCP, Mobile Ad Hoc Networks.

UNIT III

Mobile transport layer: Traditional TCP, TCP Improvements, TCP over 2.5/3G wireless networks, Support for mobility: File systems, World wide web, Wireless application protocol.

Text Book:

1. Jochen H. Schiller.: “Jochen H. Schiller”, **Second Edition**, Pearson.

Reference Books:

1. Theodore S. Rappaport.: “Wireless Communications Principles and Practice”, **Second Edition**, Pearson.

SECOND YEAR
Semester- III

Credit-4 **F.M: 20+80=100**

PAPER-XX

ARTIFICIAL INTELLIGENCE PROGRAMMING LAB

Write a Prolog program:

1. To find the factorial of a number
2. To remove the nth item from a list.
3. To find the permutation of a set.
4. To implement append for two lists.
5. To implement palindrome.
6. To find the greater of two numbers X and Y.
7. To find the greatest number in the list of numbers.
8. To find the sum of given list of numbers.
9. To find the reverse of a list.
10. To solve 8 queens' problem.
11. To solve 8-puzzle problem using best first search
12. To implement DFS.
13. To implement BFS.
14. To implement best first search.
15. To solve traveling salesman problem.

SECOND YEAR
Semester- III

Credit-4 **F.M: 100**

PAPER-XXI

PYTHON PROGRAMMING LAB

Basic Python Programs:

1. Write a program to demonstrate different number datatypes in python.
2. Write a program to perform different arithmetic operations on numbers in python.
3. Write a program to create, concatenate and print a string and accessing substring from a given string.
4. Write a python program to create, append and remove lists in python.
5. Write a program to demonstrate working with tuples in python.
6. Write a program to demonstrate working with dictionaries in python.
7. Write a python program to find largest of three numbers.
8. Write a python program to convert temperature to and from Celsius to Fahrenheit.
9. Write a python program to print prime numbers less than 100.
10. Write a python program to find factorial of a number using recursion.
11. Write a python program to that accepts length of three sides of a triangle as inputs. The program should indicate whether or not the triangle is a right-angled triangle.
12. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
13. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first the second file.
14. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
15. Write a Python class to implement power (x, n).

Advance Python Programs:

1. Write a python program to study of Python Libraries for ML application such as Pandas and Matplotlib.
2. Write a python program to Importing Data using pandas and Importing Data without pandas.
3. Write a python program to compute:
   Central tendency measures: Mean, Median, Mode.
   Measure of Dispersion: Variance, Standard Deviation.
4. Write a python program to study of Python Basic Libraries such as Statistics, Math, Numpy and Scipy.
5. Write a Python program to implement Simple Linear Regression.

SECOND YEAR
Semester- IV

Credit-4 **F.M: 100**

PAPER-XXII

COMPREHENSIVE VIVA

Objective:

The objective of comprehensive viva-voce is to assess the overall knowledge of the student in the field of Computer Science acquired over 2 years of study in the master degree program.

Contents:

The viva shall normally cover the subjects taught in all the semesters of M. Sc. Programme.

Learning Outcomes:

Viva will be conducted in 4th semester which will be covering the complete syllabus. This will test the student's learning and understanding during the course of their M Sc. programme. In doing so, the main objective of this course is to prepare the students to face interview both in the academic and the industrial sector.

Examination:

Every student will be required to undergo comprehensive viva- voce at the end of 4th semester of M. Sc. Programme. The duration of the viva will range from 20-30 min.

SECOND YEAR
Semester- IV

Credit-4 **F.M: 300**

PAPER-XXIII

PROJECT WORK AND VIVA VOCE

Each student must have an internal supervisor who is a faculty of the department/ Institution. Each student must submit the abstract of the project which will be approved by the department on the recommendation of the internal supervisor.

Guidelines: Summary/Abstract

All students must submit a summary/abstract of the project to be undertaken to the internal supervisor for approval, preferably, should be of about 3-4 pages. The content should be as brief as is sufficient enough to explain the objective and implementation of the project that the candidate is going to take up. The write up should include the followings:

1. Name / Title of the Project
2. Statement about the Problem
3. Why is the particular topic chosen?
4. Objective and scope of the Project
5. Methodology (including a summary of the project)
6. Hardware & Software to be used
7. Testing Technologies used
8. What contribution would the project make?

After the approval, the student is allowed to carry out the project in any organization/ Institution. He/She must immediately inform the internal supervisor about the name and contact details of the external supervisor in the organization/Institution. Moreover, he must report to the internal supervisor about the progress of his/her work periodically. After the end of 16 weeks, the student is required to submit the project report in the department after getting approved by the internal and external supervisors.

Guidelines for preparation of the final project report:

Good quality white executive bond paper of A4 size should be used for typing and duplication with the following specification

Left margin: 3.0cm
Right margin: 2.0cm
Top margin: 2.5cm
Bottom margin: 2.5cm

Page numbers: All text pages as well as the Program source code should be numbered in the bottom centre of the pages.

Font size of the normal Text :12pt Times New Roman
Font size of Paragraph Heading :14pt Times New Roman
Font Size of chapter Heading :18pt Times New Roman
Font size of Code :10pt Courier New

Format of the Project report:

Cover page
Certificate of the internal supervisor
Certificate of the external supervisor
Self-certificate
Acknowledgement
List of abbreviations, figures, Tables
Synopsis of the project (3-4 pages)
Main Report:
- Contents
- Objective and scope of the project
- Theoretical background
- Definition of the problem
- System Analysis and design
- System planning
- Methodology adopted
- System implementation
- System maintenance and Evaluation
- Cost benefit Analysis
- Detail life cycle of the project
- Test reports (print out of the reports)
- Print out of the code
- References

Every student has to submit the followings:

(a) One hard copy of the Project report.

(b) Soft copy of the project on CD (to be submitted to the Department) on a cover mentioning the name of the project, name of the student, Regd No., name of the department, Year.

(c) One copies of the synopsis of the project report.

Evaluation of the Project:

Evaluation of the project will be done by a jury of experts including one external expert, Head of the Department, internal supervisor, two teachers of the department. The evaluation will be done on the basis of the followings:

Project report: 200 marks,
Presentation: 50 marks,
Viva-Voce: 50 marks.